observations made rather determine this photometric value than the amount of the magnitude-equation. Dr. Gill has begun measuring star photographs with a very accurate micrometer. I cannot help thinking that if he will take a few plates near the equator, and measure them for comparison with his meridian observations, he will quickly and easily determine the magnitude-equation and find reason to revise his opinion of the value of the "screen" method. In any case the independent check would be very valuable.

On the Distribution of Stars Photographed at the University Observatory, Oxford, for the Astrographic Catalogue for Zones $+25°$ to $+29°$. By F. A. Bellamy.

In *The Observatory* for 1899 July the Astronomer Royal gave a table of the comparison of the number of stars in the Greenwich Astrographic Catalogue, zones $+64°$ to $+70°$, with those in B.D. and in the A.G.C. (Helsingfors and Christiania). The total number of stars is given for each hour of R.A. (58,170 stars for the twenty-four hours), the number per square degree—the mean being 70·0—the number in B.D. and in A.G.C., and the ratios to Greenwich measures; these ratios are 5·8 and 11·7 respectively. It should be remarked that all the plates had exposures of 6^m, 3^m, and 20^s; that all the plates not showing—with the shortest exposure—stars of the 9·0 mag. on Argelander's scale were rejected; and, thirdly, by the method adopted for measurement, which avoids overlap of adjacent plates, no stars are counted more than once: that article suggested a similar discussion of the Oxford measures.

Firstly, for reasons which need not be entered into here,* the Oxford plates have not all been taken with the uniform exposures of 6^m, 3^m, and 20^s, but these only will be used in this discussion; secondly, the plates are not so consecutive or contiguous, though as numerous, as those used in forming the table for Greenwich; and, thirdly, the basis for the rejection of a plate was not the visibility of the ninth magnitude stars, but the criterion of having three times the number of stars counted within the same area on Argelander's charts, slight allowance being sometimes made if the plate had already been measured and the total number of stars came near the limit. Table I. shows that an average of 4·0 times B.D. stars has been maintained, and 7·4 times the stars in the Cambridge Catalogue.

In spite of these differences the following table may be regarded as fairly comparable with that for Greenwich: the numbers for Greenwich are not repeated, but may be gathered from the Plate 1 accompanying this table.

* *23rd Report to the Board of Visitors, University Observatory, Oxford*, p. 7.

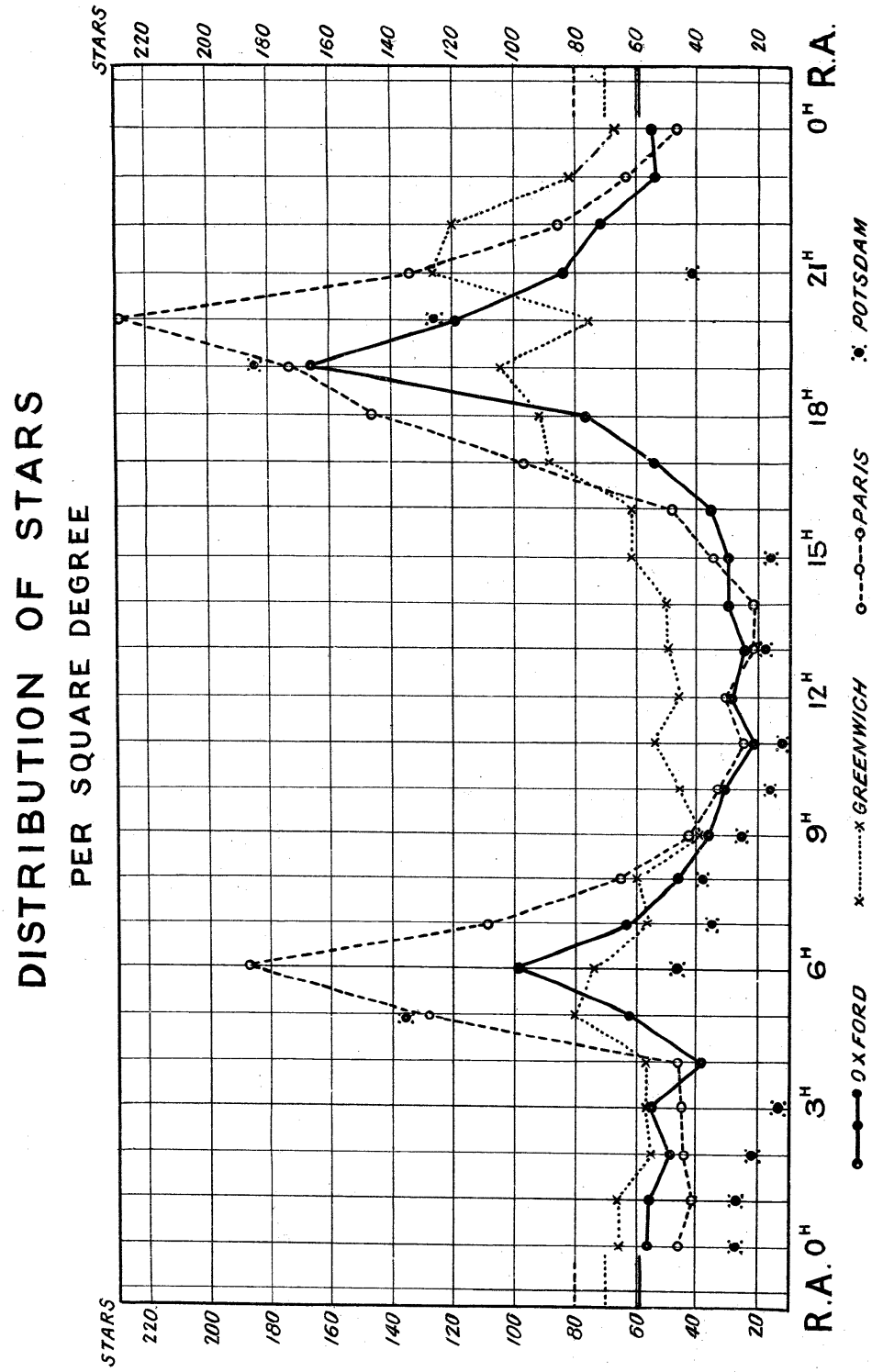


TABLE I.

Hour.	No. of plates.	Total stars measured.	Average No. of stars.	No. per sq. deg.	Stars in B.D. same area.	Ratio Oxford to B.D.	Stars in Camb. same area.	Ratio Oxford to Camb.	Hour.
0	35	9283	265	56	2005	4·6	1393	6·7	0
1	28	7227	258	55	1666	4·3	859	8·4	1
2	25	5784	231	49	1207	4·8	690	8·4	2
3	21	5428	259	55	1239	4·4	599	9·0	3
4	18	3224	179	38	744	4·4	328	9·8	4
5	23	6578	286	61	1896	3·5	822	8·0	5
6	20	9322	466	99	2541	3·7	988	9·4	6
7	23	6533	284	60	2002	3·3	934	7·0	7
8	22	4751	216	46	1403	3·4	683	7·0	8
9	25	4216	169	36	1284	3·3	600	7·0	9
10	19	2733	144	31	880	3·1	499	5·5	10
11	12	1263	105	22	485	2·6	262	4·9	11
12	18	2407	134	29	760	3·2	422	5·7	12
13	23	2574	112	24	899	2·9	530	4·9	13
14	19	2718	143	30	802	3·4	449	6·0	14
15	12	1668	139	30	575	2·9	287	5·8	15
16	13	2208	170	36	728	3·0	403	5·5	16
17	12	3024	252	54	918	3·3	478	6·3	17
18	16	5764	360	77	1574	3·7	901	6·4	18
19	17	13189	776	165	2095	6·3	1239	10·6	19
20	23	12877	560	119	2725	4·7	1754	7·4	20
21	27	10673	395	84	2410	4·4	1686	6·3	21
22	29	9768	337	72	2219	4·4	1165	8·4	22
23	33	8327	252	54	2091	4·0	1097	7·6	23
Sums	513	141539	...	...	35148	...	19068	...	...
Weighted means			276	58·7	...	4·0	...	7·4	...

From an inspection of the Greenwich curve in Plate 1 a very prominent maximum stands out at 21^h and 22^h, but that at 5^h and 6^h is less pronounced; in fact, the distribution throughout the twenty-four hours is relatively more uniform, and is maintained at a higher ratio per square degree than in the Oxford zones, where two marked maxima occur at 6^h and 19^h, and a rather definite minimum at 11^h–13^h. While the Greenwich mean density is 70·0 stars per square degree, that at Oxford is 58·7 stars.

The proximity of the Greenwich zones to the Milky Way is

in fact more continuous than that of the Oxford zones, which cut the Milky Way almost at right angles, at R.A. $5^h\ 30^m$ to $7^h\ 15^m$, and at 17^h to 21^h, whilst the Greenwich plates are actually in it from R.A. 19^h to about 5^h.

I have also collected information from the Paris Observatory Reports for 1893–97 for the Paris zones, which are contiguous to the Oxford zones on the southern side, and for the Potsdam zones * on the northern side; the results are exhibited in Table II., and included in Plate 1.

TABLE II.

Average numbers of stars measured on plates.

	Paris.				Potsdam.	
Hour.	Zone +22°. Stars.	Zone +23°, Stars.	Zone +24°. Stars.	Stars per sq. deg.	Zones +32° to +37°. Stars.	Stars per sq. deg.
0	202_8	254_7	192_4	47	124_3	26
1	132_7	238_8	244_1	41	127_3	27
2	275_6	195_7	170_8	44	110_1	21
3	324_2	171_8	234_5	45	63_1	13
4	...	278_6	176_8	47	...	...
5	593_5	735_8	448_7	127	629_{18}	134
6	780_7	1066_7	788_8	187	216_2	46
7	427_7	629_7	451_7	107	166_4	35
8	369_6	339_8	196_6	64	177_7	38
9	200_3	211_7	162_6	41	117_1	25
10	...	137_7	179_3	32	73_3	16
11	...	129_7	116_7	26	57_3	12
12	176_7	118_5	126_8	30	...	...
13	112_5	97_7	167_7	27	82_1	18
14	114_3	121_5	130_8	26	...	...
15	221_7	113_6	161_7	36	73_1	16
16	209_7	246_7	239_7	49	...	...
17	277_4	421_8	618_6	97	...	...
18	...	717_6	582_2	146	412_2	88
19	...	766_8	844_7	171	866_3	184
20	1145_5	1161_7	929_7	228	589_3	125
21	552_6	667_7	645_7	133	193_1	41
22	488_3	367_6	401_8	86	...	...
23	121_1	278_7	333_7	62	...	...

The number of plates is given after each quantity.

* *Publicationen des Astrophysikalischen Observatoriums zu Potsdam, Photographische Himmelskarte*, Band I. xxviii.

The Paris plates yield results in close agreement with those of Oxford, except that the two maxima—in the Milky Way—are more pronounced, and in consequence the mean number of stars per square degree (80·4) is even higher than that for Greenwich (70·0). With reference to this point it may be remarked that the two maxima in the Oxford curve are reduced in magnitude by the omission of a number of plates in the Milky Way which received exposures different from 6^m, 3^m, 20^s, and by the inclusion of some old plates which in this rich region contained enough stars for the purposes of the Astrographic Catalogue, though in a poorer region similar plates have been rejected.

To examine the influence of galactic latitude on such numbers the galactic latitudes of the hourly groups, both for Oxford and Greenwich, were read from a globe. The mean declination of the Oxford zones has been taken, 28° (probably +27° would be a more correct mean of the plates actually used in this paper), and the pole of the galaxy as $12^h\,41^m\,20^s + 27°\,21'$*: these readings are given in Table III. column (2). Column (3) shows the actual mean number of stars measured, as in Table I. or in the Greenwich Table; these two quantities were then taken as arguments, and a curve (Plate 2, diagrams 1 and 2) drawn through the points plotted for each hour of R.A., the ordinates (column 4) were then read from this curve and compared with column (3), and a difference (Oxford or Greenwich *minus* Oxford Curve) formed (column 5); the percentage of deviation is given in column (6).

TABLE III.

Oxford.

R.A.	Galactic Latitude.	No. of Stars.	Curve.	Obsn. *Minus* Curve.	Per-centage.	R.A.	Galactic Latitude.	No. of Stars.	Curve.	Obsn. *Minus* Curve.	Per-centage.
h	°					h	°				
0½	+35	265	200	+ 65	+ 24	12½	−88	134	115	+ 19	+15
1½	+34	258	205	+ 53	+ 20	13½	−80	112	115	− 3	− 3
2½	+29	231	230	+ 1	0	14½	−66	143	125	+ 18	+12
3½	+21	259	290	− 31	− 12	15½	−53	139	140	− 1	0
4½	+13	179	410	−231	−129	16½	−40	170	170	0	0
5½	+ 1	286	740	−454	−159	17½	−27	252	250	+ 2	+ 1
6½	−10	466	470	− 4	− 1	18½	−14	360	385	− 25	− 7
7½	−22	284	285	− 1	0	19½	− 2	776	725	+ 51	+ 7
8½	−35	216	200	+ 16	+ 7	20½	+ 8	560	505	+ 55	+10
9½	−48	169	150	+ 19	+ 11	21½	+18	395	320	+ 75	+19
10½	−61	144	130	+ 14	+ 10	22½	+25	337	265	+ 72	+21
11½	−74	105	120	− 15	− 14	23½	+33	252	200	+ 52	+20
(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)

* *Uranometria Argentina*, Gould, p. 370.

TABLE III—*continued.*

Greenwich.

R.A.	Galactic Latitude.	No. of Stars.	Curve.	Obsn. *Minus* Curve.	Percentage.	R.A.	Galactic Latitude.	No. of Stars.	Curve.	Obsn. *Minus* Curve.	Percentag
h	°					h	°				
$0\frac{1}{2}$	+ 4	305	630	−325	−108	$12\frac{1}{2}$	+49	218	150	+ 68	+3
$1\frac{1}{2}$	+ 5	310	600	−290	− 94	$13\frac{1}{2}$	+48	231	150	+ 81	+3
$2\frac{1}{2}$	+ 6	261	585	−324	−124	$14\frac{1}{2}$	+46	236	155	+ 81	+3
$3\frac{1}{2}$	+10	260	480	−220	− 85	$15\frac{1}{2}$	+42	289	175	+114	+3
$4\frac{1}{2}$	+14	262	390	−128	− 41	$16\frac{1}{2}$	+37	283	195	+ 88	+3
$5\frac{1}{2}$	+18	377	315	+ 62	+ 16	$17\frac{1}{2}$	+31	414	225	+189	+7
$6\frac{1}{2}$	+24	343	275	+ 68	+ 20	$18\frac{1}{2}$	+25	433	270	+163	+3
$7\frac{1}{2}$	+30	264	230	+ 34	+ 13	$19\frac{1}{2}$	+20	486	315	+171	+3
$8\frac{1}{2}$	+35	271	200	+ 71	+ 26	$20\frac{1}{2}$	+15	356	385	− 29	−
$9\frac{1}{2}$	+40	184	184	0	0	$21\frac{1}{2}$	+10	594	475	+119	+2
$10\frac{1}{2}$	+44	217	160	+ 57	+ 26	$22\frac{1}{2}$	+ 7	564	564	0	
$11\frac{1}{2}$	+48	247	150	+ 97	+ 29	$23\frac{1}{2}$	+ 5	378	600	−222	−5
(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6

For Oxford the agreement is good ; but there are two exceptional hours, $4\frac{1}{2}^h$ and $5\frac{1}{2}^h$, which cannot be brought within reasonable agreement without throwing out a considerable portion of the curve. But it is at once obvious that neither this Oxford curve, which has been used for Greenwich differences in Table III., nor any other curve, will suit the results from the Greenwich plates ; in other words the number of stars on a plate does not vary simply as any function of the galactic latitude. This indeed appears from the B.D. To bring out the facts clearly the following information was obtained.

The number of stars per square degree was formed from the stars in B.D. for every tenth degree and for each hour.

The points were plotted and curves drawn ; these curves were used as a basis for forming diagram 3 (Plate 2).

To show more clearly the relation of the curves of equal density to the galaxy, I have made diagram 4 (Plate 2) where the abscissæ represent galactic longitudes and the ordinates galactic N.P.D.

It can be seen that the Oxford zones pass through the minimum area of star distribution (according to the stars given in the B.D.), and are within a region containing an average of less than 12 stars per square degree from R.A. $8\frac{1}{2}^h$ to 16^h, also again from 0^h to 3^h ; in fact more than half the Oxford zones. On the contrary, they almost cut the Milky Way at right angles at 5^h 30^m, and leave it at $6\frac{3}{4}^h$ or 7^h, and again enter at $17\frac{1}{2}^h$ and remain within it till nearly 22^h. The reason of the less variation between the Greenwich maxima and minimum is also apparent, but the fall at 20^h is unexplained. It must be

Diagram 1.

OXFORD

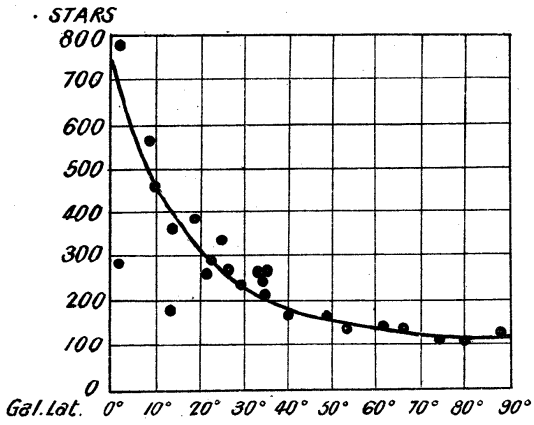


Diagram 2.

GREENWICH.

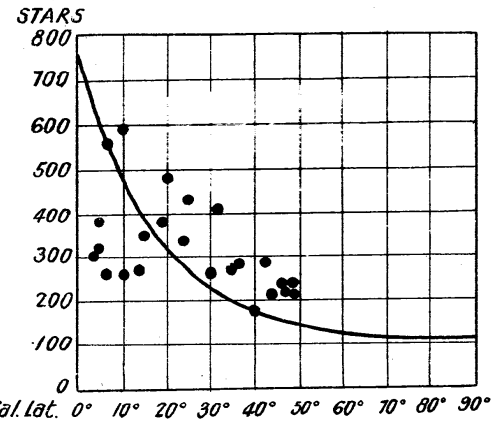
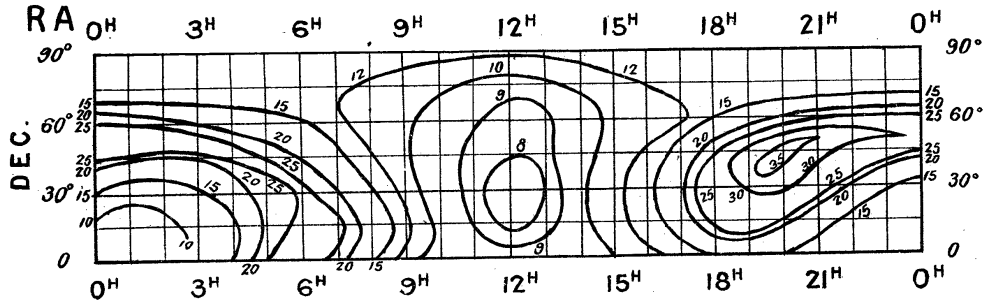


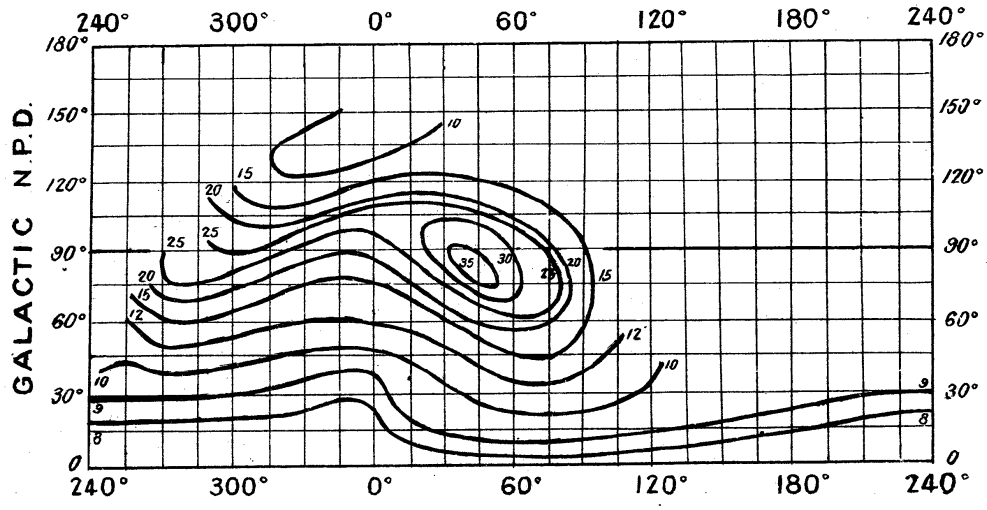
Diagram 3.



EQUAL DENSITY LINES FOR B.D. STARS

Diagram 4.

GALACTIC LONGITUDE



remembered that in comparing Plate 1 and Plate 2, diagram 3, the comparison is one between density from B.D. stars (to the $9\frac{1}{2}$ mag.) and from photographs giving stars as low as the $10\frac{1}{2}$ and 11 magnitudes.

When all the zones are completed it will be interesting to form a similar set of curves of equal density for stars to the 11th magnitude shown on the photographs and compare them with these found from Argelander's eye observations.

Comparison of the Diameters of the Images of Stars on the Greenwich Astrographic Plates with the Magnitudes given in the 'Bonn Durchmusterung.' By F. W. Dyson, M.A., and H. P. Hollis, B.A.

§ 1. This paper consists of a comparison of the diameters of the images on 232 astrographic plates with the magnitudes of the stars as given in the *Bonn Durchmusterung*. The number of stars contained in the *B. D.* varies from about 20 to 100 per plate, so that the diameters of more than 10,000 images have been considered. The object of the paper is not to obtain a formula connecting diameter and magnitude from any physical considerations, but rather to tabulate observations, to see what changes there are from plate to plate, and to test the uniformity of Argelander's scale.

The photographs considered are those whose centres are at dec. $+65°$, $+66°$, and $+67°$. They were taken at various times between 1892 April and 1898 March. The images whose diameters have been measured twice in the regular measurement of the Greenwich plates had an exposure of 6^m. The plates used were "Ilford Special Rapid," "Mawson," and "Rocket."

The diameters of the images are measured in units of $0''{\cdot}3$ or $\frac{1}{1000}$th of one réseau interval by each of the measurers, and the sum of the measures is given, so that the measures of diameter are expressed in units of $0''{\cdot}15$. Measurement of the diameters of the photographic images of stars are necessarily somewhat arbitrary, especially at some distance from the centre of the field, when the images are elongated and faint. The measurers were instructed to make some allowance for this, the general principle being to give the diameter the stars would have had if near the centre of the plate.

§ 2. The diameters of all the stars contained in the *B. D.* were tabulated for each plate. Plate 1548, the first plate in zone 67°, may be given as a specimen.